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Research on the Impact of Green Financing on Corporate Capital Structure

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Abstract. Green finance has steadily grown to be a significant factor influencing the modification of corporate capital structures in recent years as investors have become more aware of ESG and global climate rules have gotten more stringent. However, how exactly green financing affects corporate capital structures remains a key issue of concern in both academia and practice. Motivated by this, this paper aims to explore the impact of green financing on corporate capital structures. Combining literature review and case analysis, this paper selects Apple Inc. and ExxonMobil as typical cases and reveals, through comparative analysis, the differentiated impacts of green financing on different types of enterprises. The results show that green financing has a debt redistribution effect: it can extend debt maturities, reduce financing costs, and decrease reliance on equity financing. At the equity structure level, green financing attracts long-term investors by enhancing a company's "green reputation," thereby stabilizing shareholder structures and lowering the cost of equity capital. In terms of capital costs, the "greenium" effect of green bonds and the accumulation of a long-term green reputation significantly optimize the weighted average cost of capital (WACC). In sum, green financing not only improves the stability of corporate capital structures but also enhances corporate value and sustainable development capacity.

Keywords: Green financing, Capital structure, Debt structure, Equity structure, Capital cost

1. Introduction

Over the past 20 years, global green financing has experienced rapid growth and has emerged as a crucial financial force propelling sustainable development [1]. This trend has also triggered profound changes at the industry and corporate levels. As climate policies become increasingly stringent, environmental regulations are strengthened, and investor focus on Environment, Social, and Governance (ESG) performance continues to rise, the pressure on enterprises to undergo sustainable transformation has intensified significantly [2]. However, green transformation often involves high initial investment and long payback periods, requiring companies to obtain diversified, low-cost, and stable sources of funding to support their green projects and optimize their capital structures [3]. Against this backdrop, green financing instruments (such as green bonds, green loans, and sustainability-linked loans) have emerged and gradually become an important means for companies to achieve both environmental and economic goals.

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This paper explores how green financing impacts corporate capital structures via literature review and case analysis. It examines effects on debt, equity, and capital costs. Findings offer insights for firms optimizing capital structures and devising sustainable strategies, with recommendations on cost control and policy.

2. Theoretical foundation

Green Finance Theory is a framework focusing on environmental sustainability, integrating traditional finance with environmental economics and sustainable development. It uses instruments like green bonds, green loans, and carbon markets to direct capital toward renewable energy, energy efficiency, pollution reduction, and environmental management. Through green financing, enterprises aim to achieve the "triple bottom line" of balanced economic, social, and environmental development.

Capital Structure Theory studies how companies optimize the financing mix between debt and equity to maximize firm value or minimize capital cost. Its theoretical evolution includes the MM theory (Modigliani-Miller), Trade-off Theory, Pecking Order Theory, and Agency Cost Theory. The central tenet is balancing financing sources to minimize the weighted average cost of capital (WACC) and enhance corporate value.

3. The impact of green financing on corporate capital structures

3.1. The impact of green financing on corporate debt structure

Corporate capital structure refers to the composition of a company's long-term sources of funds, mainly the proportion between debt capital and equity capital. Against the backdrop of sustainable finance, green financing has gradually become an important variable affecting corporate capital structures. Green financing has a debt structure redistribution effect: it not only changes the overall scale of corporate debt financing but also alters the debt structure [4].

For high-pollution companies, as long-term debt is constrained, the proportion of short-term debt rises. Taking the U.S. oil giant ExxonMobil as an example, the company has long relied on fossil fuel businesses. Under limited access to green debt financing channels and ESG investor pressure, the impact of green financing on its debt structure is reflected in three aspects. According to its 2022 and 2023 10-K filings, first, its long-term debt issuance decreased from USD 40,599 million to USD 36,510 million within one year, reflecting the trend of constrained long-term debt financing [5]. Meanwhile, its short-term borrowings surged from USD 634 million to USD 4,090 million during the same period, significantly increasing the proportion of short-term debt. Second, limited long-term funding combined with increased short-term debt resulted in a "short-term" financing structure, increasing refinancing pressure and interest rate risk. In sum, ExxonMobil, under restricted green financing channels and ESG investor pressure, experienced a contraction in long-term debt and an increase in short-term debt, leading to reduced stability in its capital structure.

For green enterprises, long-term debt increases and financing constraints are reduced. Take Apple Inc. as an example. According to its 2023 Apple Green Bond Impact Report, the company has issued three green bonds since 2016, totaling about USD 4.7 billion, mainly funding low-carbon product design, clean energy, and emission reduction projects, to help achieve its 2030 full lifecycle carbon-neutral goal [6]. The impact of its green bond issuance on debt structure optimization is mainly reflected in three aspects: first, most green bonds are medium- to long-term (5–12 years), which effectively allow the company to replace part of its short-term debt with medium- to long-term debt,

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thereby significantly reducing refinancing pressure and optimizing its debt structure [6]. Second, with its AAA credit rating and the environmental attributes of green bonds, Apple attracted ESG investment funds and policy incentives, with some bond yields even lower than U.S. Treasuries of the same maturity, giving Apple an interest rate advantage in long-term financing and greatly lowering its financing costs [7]. Finally, by raising funds through green bonds, the company reduced reliance on equity financing for expansion and sustainability projects, thereby protecting existing shareholder interests from dilution, maintaining shareholder control and stability, and enhancing investor confidence and market image.

3.2. The impact of green financing on corporate equity structure

Equity structure is an important component of corporate capital structure, generally referring to the composition of shareholders and their shareholding proportions, reflecting the distribution of ownership. According to Flammer's research, equity structure not only reflects shareholders' financial choices but also their preferences for ESG and long-term value orientation. With the widespread issuance of green bonds, corporate equity structures have gradually shifted from short-term financial orientation to a longer-term, sustainability-oriented direction [8].

Taking Apple Inc. as an example, its Green Bond Impact Report shows that between 2016 and 2023, Apple's green bond proceeds were mainly allocated to renewable energy projects, energy efficiency improvements, carbon reduction and removal, circular economy and material recycling, and green buildings and facilities. The use of funds highly aligns with ESG-oriented investor preferences. Combining this with Flammer's empirical research, after issuing green bonds, the proportion of long-term investors increased on average by about 2.2%, and green investors by about 2.9% [8]. Tang and Zhang also found that institutional investor shareholding ratios increased by about 7.9% [9]. Although Apple did not explicitly disclose data showing a direct increase in long-term investor proportions due to green bond issuance, as one of the world's largest green bond issuers, Apple's investor structure generally follows the trends found in prior academic research—namely, higher proportions of long-term and ESG investors after issuing green bonds.

Since green bonds have the feature of "funds specifically used for environmental or emission reduction projects," and with many governments (e.g., EU, China, U.S., UK, Japan) and regulators issuing policies to support green finance, green bonds often attract ESG-oriented long-term investors [9]. In contrast to short-term investors, long-term investors place greater emphasis on corporate strategy, long-term profitability, and ESG performance. They are often large institutional investors such as pension funds, sovereign wealth funds, insurance companies, and major asset management firms. These investors manage large-scale funds, hold significant shares, and have longer investment horizons, while being more willing to influence corporate strategies through voting rights and governance mechanisms rather than pursuing short-term profits. For companies, such long-term investors are highly beneficial, not only improving the stability of equity structures but also contributing to corporate value and sustainable development.

3.3. The impact of green financing on corporate capital costs

Corporate capital cost refers to the expense incurred in raising and using capital, composed of debt capital cost, equity capital cost, and weighted average cost of capital (WACC). It is also a core metric for investment decision-making and capital budgeting, measuring financing costs and risk levels for a project or the company overall. Research shows that using green financing can effectively reduce corporate capital costs, enhance financing efficiency, and that such costs are

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generally lower than those of high-carbon companies, by about 1% [10]. Specifically, the impacts of green financing on capital costs are mainly reflected in three aspects:

First, it can reduce the cost of financing capital due to the "greenium" effect of green bonds, meaning that green bonds often enjoy lower interest rates than conventional bonds of the same maturity. This implies that companies issuing green bonds can obtain financing at lower interest rates, directly reducing financing costs. This not only provides funds for expansion, R&D, innovation, and M&A, but also strengthens competitiveness and market position. Zerbib's empirical research found that green bond interest rates are on average 1–9 basis points lower than ordinary bonds, showing investors—particularly ESG investors—have a stronger preference for green bonds, accepting lower yields [3]. For example, according to the Climate Bonds Initiative (CBI) report, Spanish energy company Iberdrola issued green bonds that were priced in the primary market about 3–5 basis points lower than comparable non-green bonds, fully demonstrating the greenium effect [11]. The interest rate advantage from greenium not only reduced financing costs but also enhanced competitiveness in capital markets, providing financial conditions for long-term stable development.

Second, the cost of equity capital is essentially investors' required compensation for risk. Green financing can enhance a company's "green reputation." Green reputation refers to the environmental and sustainable image gradually formed in capital markets and the public sphere through active green financing (such as issuing green bonds or loans) and implementing sustainable strategies. Research shows that repeated green bond or loan issuances can accumulate "green reputation," further reducing equity capital costs [12]. Companies with higher green reputations are more likely to attract long-term investors such as ESG funds and pension funds. Since these investors focus more on long-term profitability and ESG performance, they are willing to accept lower risk premiums, directly lowering equity capital costs. Furthermore, long-term investors tend to hold shares stably rather than trade frequently, thereby increasing equity stability. Stable equity structures also stabilize stock prices, lowering perceived risk and ultimately reducing equity capital costs.

Finally, WACC (Weighted Average Cost of Capital) measures corporate capital structure and financing efficiency and serves as an important benchmark for investment decisions. Companies can optimize and directly reduce WACC through green financing. According to World Scientific's research, companies issuing green bonds had WACC about 25 basis points lower than companies issuing conventional bonds [13].

$$\mathrm{WACC} = \frac{\mathrm{E}}{\mathrm{V}} \times \mathrm{Re} + \frac{\mathrm{D}}{\mathrm{V}} \times \mathrm{Rd} \times \left(1 - \mathrm{Tc}\right) \tag{1}$$

In (1), E represents equity capital, D represents debt capital, and the two together constitute total capital V (V = E + D). Re represents equity capital cost, Rd represents debt capital cost, and Tc is the applicable corporate income tax rate.

When both equity capital cost and debt capital cost decrease (i.e., Re and Rd decrease), WACC also decreases. Furthermore, repeated issuance of green bonds can accumulate "green reputation," causing Rd to decline with increasing green reputation, producing a long-term reduction in capital cost and continuously optimizing WACC.

4. Recommendations

From a policy perspective, governments should further improve green financial systems by providing tax incentives or subsidies to encourage companies to adopt green financing and enter green capital markets.

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In fact, many countries have already advanced green financing development through concrete policies. For example, China established pilot zones for green finance reform and innovation to practically increase understanding of green credit and green bond mechanisms [14]; the U.S. has offered large-scale tax incentives under the Inflation Reduction Act to stimulate and encourage green investments [15]. These practices further demonstrate the importance of green financing and provide companies with lower-cost financing options.

From the perspective of corporate development, enterprises should improve their ESG performance and quality of environmental information disclosure to build "green reputation" and attract ESG-oriented long-term investors. Based on this, companies can use green bonds, green loans, and other tools, leveraging the greenium effect to lower debt capital costs and reduce financing burdens.

Moreover, continuously accumulating "green reputation" will further reduce equity capital costs and optimize WACC. In addition, green financing can improve capital market trust and recognition of enterprises, thereby increasing corporate market value.

5. Conclusion

This study investigates the impact of green financing on corporate capital structures, finding it crucial for optimization. Green financing aids firms in achieving financial stability and sustainable development by improving debt and equity structures and lowering capital costs. Green bonds and loans offer long-term, low-cost funding and enhance green reputation, attracting long-term investors. Theoretically, it reveals the multi-dimensional impacts on capital structures. Case analyses of companies like Apple and ExxonMobil show varying capital market responses to ESG performance. Governments should improve green financial systems through incentives to reduce costs. Companies should enhance ESG performance and disclosure to build reputation, attract investors, and stabilize equity. In summary, green financing supports corporate development, optimizes capital structures, and promotes sustainability. As the global green transition accelerates, its importance will grow.

However, this study has certain limitations. First, the case analysis mainly relies on the publicly available annual reports and green bond reports of Apple and ExxonMobil, with limited representativeness of the sample. Future studies could enhance generalizability through larger-sample empirical research. Second, the ways in which green financing influences capital structure are relatively complex—for example, differences in green bond pricing and industry characteristics still require deeper exploration. Future research could focus more on the short- and long-term effects of green financing on corporate capital structures across industries and countries, and combine quantitative data with cross-country comparative analysis to further enrich the understanding of green financing and corporate sustainability.

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